Resistance Gene To Fortify Soy Against Exotic Pest

Since first being detected in Wisconsin in 2000, the soybean aphid, *Aphis glycines,* has spread across the Midwest and to the Deep South, causing millions of dollars in losses to the legume crop. Growers have countered severe outbreaks by applying insecticides, adding $12 to $25 per acre to their production costs.

In Urbana, Illinois, ARS and University of Illinois (UI) scientists have collaborated on finding a cheaper, long-term solution to the problem. In early 2004, their efforts paid off with discovery of a single gene—tentatively named *Rag1*. The gene was found in an older soybean cultivar and conferred resistance to the aphid.

Discovery of the resistance, reported in the journal *Crop Science,* helps set the stage for seed companies to breed new, high-yielding cultivars that should withstand the sap-sucking pest with little or no help from insecticides.

Such cultivars could be on the market by 2008, reckons Glen Hartman, a plant pathologist in ARS's Soybean/Maize Germplasm, Pathology, and Genetics Research Unit in Urbana. His UI colleagues there are senior research specialists Curtis Hill and Shawn Carlson, soybean breeder Brian Diers, and graduate student Yan Li.

They found the aphid resistance after screening 800 commercial cultivars and 3,000 germplasm accessions from the USDA soybean germplasm collection housed at the university. None of the North American cultivars tested showed resistance to the aphid, which causes stunted growth, disfigured leaves, poor pod formation, and the plant's eventual death. Aphid feeding can also infect soybean plants with viral diseases.

The first promising clue to resistance arose from tests of Dowling, Jackson, and PI200538. The first two are old southern cultivars that are no longer grown but are considered genetic forebears of some of today's U.S. soybeans. The third is a USDA plant introduction that hasn't been used commercially.

In greenhouse and field tests, neither wingless females nor their nymph offspring survived for long when confined to leaves of these three soybeans. Typically, 94 to 100 percent of female aphids died within 10 days, compared to 17 percent on Pana, a susceptible check variety. Nymphs suffered a similar fate. And when not confined, the aphids quickly abandoned the resistant plants.

Exactly how the resistance works isn't known. "We do know it significantly restricts aphid colonization on plants that contain at least one copy of the gene. Aphid survival, fecundity, and development are all reduced," says Hill.

Since discovering the resistance, the ARS-UI team has mapped the trait's genetic whereabouts on the resistant beans' DNA. The team also identified DNA marker regions and devised technology to detect them so that breeders can rapidly identify resistant plants without using aphids. ARS and the university are seeking to patent and license the technology.

The scientists, meanwhile, are studying other aphid-resistance genes and likewise plan to bring them to bear in the fight against the pest.—By **Jan Suszkiw,** ARS.

This research is part of Plant Diseases, an ARS National Program (#303) described on the World Wide Web at www.nps.ars.usda.gov.

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The Importance of Germplasm Collections

After screening thousands of germplasm accessions, scientists find a gene for resistance to the soybean aphid in older soybean cultivars.

BAMPHITLHI TIROESELE (D279-2)

Soybean aphids *(Aphis glycines).*

JIM KALISCH (D279-1)

Close-up of a soybean aphid.